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To: J. F. Whidby **Date:** July 2, 1992

From: J. O. Stimler and G. H. Bokelman

Subject: Feasibility Study of Physical Methods for Blend Composition Analysis

On May 15 we participated in an Applied Research Technical Seminar on tobacco blend analysis. As a part of our presentation, we discussed future method development. These suggestions and relevant prior work were further elaborated in a recent memo, "Proposal for Development of a Rod Level Blend Composition Capability on a Shred by Shred Basis," dated June 2, 1992. This approach was coordinated with the ARD Process monitoring group and we jointly agree it is complementary to their efforts. Following review of that memo by interested parties, we are now proposing a 4-month pilot concept study to evaluate the feasibility of using new physical methods for blend composition analysis on a single cigarette rod sample size. Understanding of the product at the rod level is an increasingly important issue for both PM and competitors brands. In order to maximize the information content of rod level samples it is necessary to push the limits of current physical methods.

The essence of this study is to identify and systematically exploit empirical differences between blend components that are still evident for cut filler. For example, work done by Nancy Ryan and her group suggests that the following characteristics may be useful for identifying specific tobacco components: reconstituted tobacco, texture, aspect ratio and color; expanded stems, shape and texture; expanded lamina, color; Oriental filler, color and number of trichomes; bright lamina, thickness; and burley lamina, color and characteristic spots from casing spray. Existing discrimination techniques will be enhanced and augmented through application of computerized pattern recognition and expert system data analysis techniques.

An assessment of in-house capabilities indicates that essentially all of the equipment required for a feasibility study currently exists within R&D. The possible known exception is a high resolution color camera. Two color cameras of moderate resolution currently exist and it is proposed to use one of them for the short term feasibility study. Some risk exists that this will not prove to be adequate and a more capable device will be required. Other equipment needs consist of a stand, microscope with camera capability, image processing boards, workstation, and minor software components. These components have been located and are tentatively available for a short term study. It will take about a month to assemble this equipment into a workable environment.

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A two-pronged investigation approach will be utilized. First, methods will be developed to discriminate between filler components currently hand-picked by CTSD technicians. These components consist of expanded stems, RL and RCB. The longer range goal of this aspect of the study would be to expedite the processing of samples in a manner similar to current practice, but with a greatly increased throughput. The second effort will concentrate on discriminating lamina components - bright, burley, and Oriental. Discriminating additional components will increase the informational content of the services provided by CTSD. The longer term goal will be to combine and automate both of the above functions into an at-line capability. It is expected that considerable progress in both areas can be achieved during the feasibility study.

Additional technique development will be required following demonstration of the above capabilities. A means is required for presenting the tobacco filler to the viewing zones of the device in a largely non-overlapping manner. Techniques for estimating the weight of individual shreds would also be required. Presuming successful development of discrimination capabilities during the feasibility study, subsequent automated implementation of the same capabilities would then be desirable.

In addition to the equipment previously described, the contributions of the following individuals would be important to the success of this feasibility study: Jack Stimler (full time), Doug McRae (part-time), Nancy Ryan (limited advisory role), Charles Harward (limited advisory role), John Blankinship (part-time), and Gordon Bokelman (limited advisory role).

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